

Remarks

Currently pending in the application are claims 30 and new dependent claims 45-48. Support for claims 45-48 can be found at, for example, paragraphs [0026], [0033], and former claim 23. No new matter has been added. In view of the amendments above and following remarks, Applicants respectfully request reconsideration by the Examiner, and advancement of the application to allowance.

35 U.S.C. § 103

The Examiner rejected claims 16-28 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Maekawa et al. (US 2002/0040098) in view of Eichorst et al. (US 2001/0019813) and further in view of December et al. (US 6,471,843). Applicants traverse these rejections for the following reasons.

According to method claims 30 and 45-48 of the present application, a non-isocyanate based polyurethane product is produced by (i) mixing one or more cyclocarbonate resins with at least one nano-clay having a platelet thickness of less than 25 Å and an aspect ratio higher than 10 or a nanocomposite formed from the nano-clay; and with at least one hardener to form a composition; and (ii) curing the composition.

In comparison, Maekawa et al. teaches a method of forming an aqueous dispersion by mixing block polymers and isocyanate-based polyurethanes. Maekawa et al. further teaches that crosslinkable set of functional groups, such as the combination of cyclocarbonate and carbonyl groups, may be introduced into both of the block copolymer and isocyanate-based polyurethane. Thus, these functional groups are part of the isocyanate-based polyurethane. Maekawa et al. does not teach or suggest a method of forming a non-isocyanate based polyurethane by mixing a cyclocarbonate resin with a

nano-clay (or a nanocomposite formed from the nano-clay) and with a hardener to form a composition and then curing the composition to form the non-isocyanate based polyurethane. Thus, Applicants method is clearly distinguished from the method taught in Maekawa et al.

Adding December et al. and Eichorst et al. to Maekawa et al. also does not bring one skilled in the art closer to Applicants claimed method. Rather, December et al.'s method of forming non-isocyanate based polyurethanes is based on the reaction of three specific components: (A) a polymer containing at least one primary carbamate group and at least one cationic salting site; (B) a curing agent; and (C) a compound having a MW of 131-2000 and at least one primary carbamate group and at least one branched or straight chain alkyl group. *See December et al.* at col. 2, ls. 55-68. Moreover, Eichorst et al. has been added for teaching the addition of specific platelets of clay particles into a sulfonated isocyanate-based polyurethane binder. Thus, Maekawa et al. combined with December et al. and Eichorst et al. does not lead one to a method of forming a non-isocyanate based polyurethane by mixing a cyclocarbonate resin with a nano-clay (or a nanocomposite formed from the nano-clay) and with a hardener to form a composition and then curing the composition to form the non-isocyanate based polyurethane as presently claimed.

Because Applicants method is clearly distinguished from the method taught in Maekawa et al., Applicants submit this publication is no longer the closest prior art. Applicants respectfully redirect the Examiner's attention to the Examples in the present application in which the physical and mechanical properties of non-isocyanate based polyurethanes prepared conventionally using cyclocarbonate resins and hardeners

(Examples 16, 17 and 18) was compared against inventive non-isocyanate based polyurethanes prepared using cyclocarbonate resins, hardeners and nano-clays (Examples 19, 20 and 21).

As Tables 5, 6, 8, 9 and 10 demonstrate, the non-isocyanate based polyurethanes produced by the method of the present invention provide significantly reduced gel times, water uptake and deformation as well as increased lap shear strengths. For instance, the following tables summarize these unexpected results for inventive Example 19 and comparative Example 16:

Table 1

Property	Example 16 (comparative)	Example 19	% Improvement
Gel Time (min)	155	135	13
H ₂ O Uptake (%)	25.9	20.6	20

Table 2 (Cured for 1 day at Room Temperature)

Property	Example 16 (comparative)	Example 19	% Improvement
T _g (°C)	-19	-9	52
Lap Shear Strength (MPa)	1.04	1.78	71
Deformation (mm)	0.45	0.43	4.4

Figures 1 and 2 provide evidence that the inventive method also reduces reaction times. For example, as shown in Figure 1, the absorption at 1795 cm⁻¹ attributed to the carbonyl of the cyclocarbonate groups is almost three times less when the composition contained nano-clay (NPU-1) as compared to when the nano-clay was not present (RPU-

1) thus indicating a significantly reduced reaction time for the inventive method. Moreover, reaction was complete for the inventive method within 4 days while the comparative required 8 days. *See present application* at paragraph [0126].

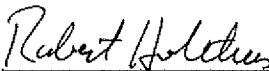
The surprising results above are neither taught, fairly suggested or predicted in the publications cited above nor were they expected by the Applicants. Accordingly, Applicants submit that claims 30 and 45-48 are not obvious in view of the publications cited above and respectfully request the rejections under 35 U.S.C. § 103(a) be withdrawn.

Conclusion

Applicants respectfully submit that the application is now in condition for allowance, and respectfully request an issuance of a Notice of Allowance directed towards the pending claims.

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Respectfully Submitted,



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